

A phytosociological study on *Betula Platyphylla* forests in Daxing'an Mountains of China

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Abstract For the first time in this paper the forests of *Betula platyphylla* in Daxing'an Mountains are subdivided by phytosociological methods. Three community types of *B. platyphylla* forest have been differentiated, e.g., *Rhododendron dahuricum*-*Betula platyphylla* community, *Corylus heterophylla*-*Betula platyphylla* community and *Artemisia stolonifera*-*Betula platyphylla* community. The distributed elevation, stand height, differential species, major composition species of tree layer, shrub layer and herb layer for each community were detail described

Key Words: Phytosociology, *Betula platyphylla* forests, Plant community classification

Introduction

Betula Platyphylla Sukatchev occurs frequently throughout whole region (49°20'~53°30' N, 119°40'~127° 22' E) of Daxing'an Mountains (Zhou 1991). As tall as 24 m and attaining diameter seldom in excess of 40cm under favorable conditions, it is a short-lived tree species with r-strategy, and its ecological longevity is less than 120 a (Yang *et al* 1994), and classified as an early succession species. Due to its adaptation to the disturbed habitats and intensive light conditions, white birch has the ability quickly to colonize the exposed sites which were originally occupied by *Larix gmelinii* (Rupr) Rupr., following forest fire and clearcut and form a even-aged pure stand (Xu 1998).

Betula platyphylla forests is one of the most important forest types in the region and near one third of the mountains are mainly covered by it. Since 1950 the survey on vegetation of the region has been carried out several times with various phytosociological methods, as to *B. Platyphylla* forests, several community types have been recognized. However, for the first time in this paper, the forests of *B. platyphylla* in Daxing'an Mountains are subdivided by the Braun-Blanquet table method. The following community types can be differentiated.

- (1) *Rhododendron dahuricum*-*Betula platyphylla* type;

- (2) *Corylus heterophylla*-*Betula platyphylla* type;
- (3) *Artemisia stolonifera*-*Betula platyphylla* type.

Methods

The vegetation investigation of *B. platyphylla* forests was carried out in whole range of Daxing'an Mountains. Climatic data indicates a mean annual precipitation of 360~500 mm, annual temperatures average below 0°C, with means of January of -25°C~30°C, and for July 15~20 °C. The region is characterized by continental climate with long cold winter and short cool summer, and is the coldest region of China.

The sample plots were collected at different places of the region with area of 400 m². The investigation was carried out using phytosociological method (Mueller-Dombois and Ellenberg 1974). The table of the floristic composition of *B. platyphylla* forests lists plant species with coverage and the scientific names used in this paper is on the basis of a key for identification of plants in Northeast China (Liu *et al* 1959).

Results and discussion

The differentiated table was made according to the analysis of vegetation data collected from the forests dominated by *B. platyphylla* with table method (Mueller-Dombois and Ellenberg 1974). Three community types for the white birch forests was recognized in Daxing'an Mountains, including *Rhododendron dahuricum*-*Betula platyphylla* type, *Corylus heterophylla*-*Betula platyphylla* type and *Artemisia stolonifera*-*Betula platyphylla* type (Table 1).

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Table 1. The differentiated table of betula platyphylla forests in Daxing'an Mountains

Releve No.		10	12	3	8	20	6	5	7	17	23	21	16	18	22	24	25	26	27	29	19	30	28	15		
Running Number		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Number of Species		24	29	26	32	30	26	16	33	32	31	14	18	33	13	21	30	19	24	30	34	41	30	33	38	
<i>Artemisia stolonifera</i>	herb	.	2	2	2	+	+	r	.	+	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Saussurea neoserrata</i>	herb	3	+	.	+	1	r	3	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Vicia cracca</i>	herb	3	2	r	2	r	.	1	l	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Scabiosa comosa</i>	herb	2	1	.	r	.	2	+	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Polygonatum humile</i>	herb	1	r	+	+	r	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Anemone narcissifolia</i>	herb	r	+	r	.	.	2	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Hemerocallis minor</i>	herb	2	.	r	.	r	3	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Carex callitrichos</i>	herb	.	.	.	.	.	.	.	.	.	+	5	3	2	5	2	.	5	.	.	.	.	.	.	.
<i>Rhododendron dahuricum</i>	shrub	.	.	.	.	.	.	.	.	.	.	4	2	3	2	2	3	2	.	.	.	.	.	.	.
<i>Athyrium crenatum</i>	herb	.	.	.	.	.	r	.	.	.	.	.	2	2	.	2	2	+	.	.	.	.	.	.	.
<i>Clematis brevicaudata</i>	herb	.	.	.	.	.	.	.	.	.	.	2	.	r	2	.	+	r	.	.	.	.	.	.	.
<i>Trientalis europaea</i>	herb	.	.	.	.	.	.	.	.	.	.	.	+	.	2	+	+	2	.	.	.	.	.	.	.
<i>Geranium dahuricum</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	2	r	+	+	2	r	r
<i>Corylus heterophylla</i>	shrub	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	3	3	2	3	5	2
<i>Rubia cordifolia</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	r	2	2	r	+	2
<i>Pteridium aquilinum</i>	fern	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	r	2	r	2
<i>Lysimachia davurica</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	+	2	r
<i>Thalictrum simplex</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	2	.	+	r
<i>Betula platyphylla</i>	tree	4	5	4	4	3	4	2	.	4	3	3	5	3	4	3	3	5	3	5	4	3	4	2	4	
<i>Sanguisorba officinalis</i>	herb	+	r	+	2	2	+	r	+	2	+	.	.	.	.	.	r	.	2	r	+	+	r	+	r
<i>Deyeuxia angustifolia</i>	herb	2	1	3	2	.	2	+	.	+	2	r	2	.	2	2	+	2	5	2	.	2	2	.	.	
<i>Artemisia laciniata</i>	herb	.	.	+	2	.	r	.	+	.	2	.	.	+	.	.	+	.	2	.	2	r	+	.	2	
<i>Convallaria keiskei</i>	herb	.	.	.	1	.	.	.	.	.	+	.	2	2	.	.	2	.	2	2	+	2	2	2	+
<i>Fragaria orientalis</i>	herb	.	.	.	+	2	2	.	.	2	2	.	.	2	.	2	.	.	.	2	2	r	.	.	+	
<i>Larix gmelinii</i>	tree	.	2	.	2	2	.	+	.	2	3	1	.	3	3	2	2	.	.	.	2	3	.	.	.	
<i>Rosa davurica</i>	shrub	.	2	.	3	r	2	.	r	1	.	r	.	.	.	1	.	+	.	.	2	.	2	.	.	
<i>Carex ussuriensis</i>	herb	.	2	.	4	.	3	.	+	.	3	r	.	+	.	.	3	.	.	.	.	3	2	.	3
<i>Adenophora tetraphylla</i>	herb	.	2	.	.	.	2	.	.	+	.	.	3	2	.	.	+	+	.	.	+	r	.	+	r	
<i>Galium verum</i>	herb	1	.	+	2	+	.	.	r	.	+	.	.	r	.	.	.	r	.	.	.	2	.	.	r	1
<i>Equisetum silvaticum</i>	herb	.	1	+	+	2	2	r	.	2	+	.	.	.	.	.	.	.	r	.	+	.	.	.	r
<i>Pyrola incarnata</i>	herb	2	2	.	.	.	2	.	.	.	.	.	.	4	.	2	2	5	+	+	2	2	.	.	.
<i>Chamaenerion angustifolium</i>	herb	.	.	.	2	.	r	.	.	2	+	+	.	.	.	.	r	.	.	r	r	1	r	.	.
<i>Populus davidiana</i>	tree	.	.	r	1	.	.	.	r	r	.	.	.	1	.	.	.	.	.	3	2	2	2	3	.
<i>Saussurea serrata</i>	herb	.	+	1	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	r	.	+	r
<i>Lathyrus humilis</i>	herb	r	.	+	.	2	2	+	+	+	.	.	.	2	.	.	3	.	.	.	.	.	.	.	.
<i>Maianthemum bifolium</i>	herb	.	.	r	.	.	2	.	.	.	2	.	.	.	+	2	2	3	.	r	.	1	.	.	.	
<i>Vicia pseudocracca</i>	herb	2	.	.	+	r	.	.	+	.	+	.	.	+	.	.	.	.	.	.	2	1	.	2	.
<i>Sedum aizoon</i>	herb	.	1	r	.	.	r	.	r	.	+	.	.	+	.	.	.	.	.	.	r	+	.	.	r
<i>Filipendula palmata</i>	herb	.	2	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	.	2	2	2
<i>Carex lanceolata</i>	herb	5	.	1	.	2	.	.	.	.	.	.	.	.	.	3	.	+	.	2	.	.	.	+	.
<i>Moehringia lateriflora</i>	herb	2	.	.	.	r	.	.	.	r	.	.	.	.	.	.	.	.	.	.	+	r	.	+	+
<i>Vicia unijuga</i>	herb	.	.	r	+	.	.	.	+	.	+	.	.	r	.	.	.	.	.	.	2	2	r	.	.
<i>Rubus saxatilis</i>	herb	.	.	.	.	.	.	.	+	.	+	r	.	2	.	2	2	.	.	.	2	2	.	.	.
<i>Spiraea media</i>	shrub	.	.	.	1	.	2	.	.	1	2	2	.	r	.	1	.	.	.	.	.	.	.	.	.
<i>Iris uniflora</i>	herb	2	.	.	.	2	2	.	.	.	.	.	+	.	.	.	2	.	+	r	.	.	.	.	.
<i>Valeriana stubendorfi</i>	herb	2	.	r	r	.	.	.	.	r	r	.	.	.	.	.	.	.	r	.	r	.	r	.	.
<i>Veronica sibirica</i>	herb	.	2	.	.	.	.	.	.	2	2	.	.	.	.	.	.	.	.	2	r	2	2	.	.
<i>Vaccinium vitis-idaea</i>	shrub	.	.	.	.	.	.	3	.	.	.	3	.	.	2	+	2	3	.	.	.	2	.	.	.
<i>Adenophora gmelinii</i>	herb	.	r	+	+	.	.	r	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.
<i>Asperula maximoviczii</i>	herb	.	2	.	2	.	.	.	.	.	.	.	.	.	.	2	.	.	r	.	.	r	.	.	+
<i>Quercus mongolica</i>	tree	.	.	.	.	.	.	.	.	.	.	.	r	l	.	.	.	.	.	2	2	2	2	.	.

Continue Table 1

Releve No.		10	12	3	8	20	6	5		7	17	23	21	16	18	22	24	25	26	27	29	19	30	28	15
Running Number		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Number of Species		24	29	26	32	30	26	16	33	32	31	14	18	33	13	21	30	19	24	30	34	41	30	33	38
<i>Salix starkeana</i>	shrub	.	.	.	.	r	.	.	.	1	.	.	.	.	.	.	.	.	2	.	.	.	2	.	3
<i>Geranium erioteimon</i>	herb	.	.	1	.	.	2	.	.	.	.	.	.	+	.	.	.	.	2	2	.	.	.	.	.
<i>Plomonium linifolium</i>	herb	2	.	r	.	.	.	.	.	.	+	.	r	.	.	.	.	.	.	.	.	+	.	.	.
<i>Trollius ledebourii</i>	herb	.	.	.	.	.	.	.	.	2	.	.	.	r	.	.	.	.	+	.	.	+	.	.	+
<i>Ligularia fischeri</i>	herb	.	.	r	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	2	.	r	.	.	.
<i>Thalictrum aquilifolium</i>	herb	2	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	r	.	.	.	+	.	.
<i>Carex schmidtii</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	3	.	2	2	3
<i>Paeonia obovata</i>	herb	.	2	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	r	.	.	r	+	.
<i>Equisetum pratense</i>	herb	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	+	.	.	.	.	2	.
<i>Rubus arcticus</i>	herb	.	.	.	.	.	.	.	r	.	.	.	2	.	.	.	.	.	.	+	.	2	.	.	.
<i>Aegopodium alpestre</i>	herb	.	.	.	+	.	2	.	.	.	.	.	.	r	.	2	.	.	.	.	.	.	.	.	.
<i>Bupleurum longiradiatum</i>	herb	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	2	.	.	.	+	r	.	.	.
<i>Aconitum volubile</i>	herb	2	+	.	.	.	.	.	+	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Lactuca sibirica</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	r	.	.	.	.	.	.	r	r
<i>Trifolium lupinaster</i>	herb	.	2	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	2	+	.	.	.
<i>Achillea setacea</i>	herb	.	.	r	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	r
<i>Geranium vlassorianum</i>	herb	.	.	.	.	.	.	r	+	.	.	+	.	.	.	.	.	.	.	.	.	r	.	.	.
<i>Lespedeza bicolor</i>	shrub	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	+	.	.	3	.	.	2	.	.
<i>Viola acuminata</i>	herb	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	r	.	.	r	.	.	.	+	.
<i>Betula davurica</i>	tree	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	r	r	.
<i>Cimicifuga dahurica</i>	herb	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	+	.	.	.	2	.	.	.	.
<i>Ledum palustre</i>	herb	.	.	.	.	.	.	3	.	.	.	5	.	.	3	.	.	.	.	.	.	.	.	.	.
<i>v.angustum</i>																									
<i>Poa subfastigiata</i>	herb	.	.	.	2	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r
<i>Salix raddeana</i>	tree	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	2
<i>Alnus sibirica</i>	tree	.	.	.	.	r	.	.	.	.	.	.	.	3	.	.	.	2	.	.	.	.	.	.	.
<i>Angelica czernaevia</i>	herb	.	.	.	.	r	.	.	.	.	.	.	.	r	.	.	.	.	.	.	r	.	.	.	.
<i>Cimicifuga simplex</i>	herb	.	.	.	r	.	.	.	r	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.
<i>Linnaea borealis</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	2	+	.	2	.	.	.	.	.	.	.	.
<i>Polygonatum odoratum</i>	herb	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	+
<i>Potentilla fragarioides</i>	herb	+	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
<i>Stachys baicalensis</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	2	.	.	.	.	r
<i>Synurus deltoides</i>	herb	.	.	+	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.
<i>Vaccinium uliginosum</i>	shrub	.	.	.	.	.	.	4	.	.	r	.	.	.	.	.	.	.	+	.	.	.	.	.	.
<i>Vicia venosa</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	2	.
<i>Angelica maximowiczii</i>	herb	.	.	.	.	r	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cacalia hastata</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.
<i>Cypripedium guttatum</i>	herb	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.
<i>Rumex acetosa</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Continue Table 1

Releve No.		10	12	3	8	20	6	5		7	17	23	21	16	18	22	24	25	26	27	29	19	30	28	15
Running Number		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Number of Species		24	29	26	32	30	26	16	33	32	31	14	18	33	13	21	30	19	24	30	34	41	30	33	38
<i>Vicia baicalensis</i>	herb	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
<i>Viola mandshurica</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	+
<i>Angelica dahurica</i>	herb	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cirsium pendulum</i>	herb	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cnidium dahuricum</i>	herb	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Galium boreale</i>	herb	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Gentiana macrophylla</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
<i>Heracleum barbatum</i>	herb	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Ribes pauciflorum</i>	shrub	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Salix gmelinii</i>	shrub	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
<i>Spiraea dahurica</i>	shrub	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Aconitum kusnezoffii</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.
<i>Adenophora denticulata</i>	herb	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Adenophora stenanthium</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Aquilegia viridiflora</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.
<i>Astragalus davuricus</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.
<i>Atractylis japonica</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.
<i>Corydalis sibirica</i>	herb	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Delphinium kor-shinskyanum</i>	herb	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Dianthus superbus</i>	herb	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Eriophorum japonicum</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.
<i>Erodium stephanianum</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
<i>Euphorbia esula</i>	herb	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Fritillaria maximowiczii</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.
<i>Hieracium umbellatum</i>	herb	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Hierochloa glabra</i>	herb	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Iris dichotoma</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
<i>Kummerowia stipulacea</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r
<i>Liparis japonica</i>	herb	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Paris verticillata</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.
<i>Peucedanum baicalense</i>	herb	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Pulsatilla dahurica</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Ribes mandshuricum</i>	shrub	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.
<i>Rhapontica uniflora</i>	herb	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Rubia boreale</i>	herb	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Saussurea japonica</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Scorzonera glabra</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Scutellaria scordifolia</i>	herb	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Scutellaria baicalensis</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r
<i>Smilacina davurica</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.
<i>Stellera chamaejasme</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r
<i>Stipa baicalensis</i>	herb	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Vicia amoena</i>	herb	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Zygadenus sibiricus</i>	herb	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.

Description of the community types

1. *Rhododendron dahuricum*-*Betula platyphylla* community

The *Rhododendron dahuricum*-*Betula platyphylla* community is generally located on dry steep slopes (Table 2), in elevation from 400 m to approximately

1200 m. Dominant white birch typically reaches heights of 15 m to 25 m at maturity.

1.1 Character and differential species

Rhododendron dahuricum

Athyrium crenatum

Clematis brevicaudata

Trientalis europaea

1.2 Major composition species

Tree layer

Betula platyphylla, *Larix gmelinii*, *Quercus mongolica* *Alnus sibirica*.

Shrub layer

Rhododendron dahuricum, *Rosa davurica*, *Spiraea media*, *Vaccinium vitis-idaea*, *Rubus arcticus*, *Sorbaria sorbifolia*, *Sorbus pohshanensis*.

Herb layer

Deyeuxia angustifolia, *Convallaria keiskei*, *Fragaria orientalis*, *Carex ussuriensis*, *Adenophora tetraphylla*, *Perola incarnata*, *Lathylus humilis*, *Maianthemum bifolium*, *Vicia unijuga*, *Linnaea borealis*, *Aegopodium alpestre*, *Gymnocarpium continetalis*, *Mitella nuda*.

1.3 Number of species

Mean: 21.1 species

Range: 13-33 species

Table 2. Stand data of *Betula platyphylla* forests in Daxing'an Mountains

Releve No.	Running No.	Elevation /m	Slope aspect	Inclination	Plot Area / m ²	Tree layer height /m		Shrub layer height /m		Herb layer height /m		Date
						H /m	C(%)	H/m	C(%)	H /m	C(%)	
10	1	850	N10E	4	400	12.0	60	0.0	0	0.5	40	1986/07/16
12	2	600	S30W	3	400	8.0	70	2.0	20	0.5	40	1986/08/11
3	3	900	-	-	400	12.0	50	0.0	0	0.7	65	1986/06/21
8	4	700	N	8	400	14.0	50	1.2	2	0.8	70	1986/07/02
20	5	810	-	-	400	15.0	60	1.0	20	0.4	45	1986/06/18
6	6	650	N	5	400	12.0	80	1.0	10	0.8	90	1986/07/22
5	7	590	N	5	400	4.0	10	0.4	25	0.4	85	1986/07/22
2	8	780	-	-	400	13.0	50	1.0	30	0.4	40	1986/06/18
7	9	1250	S	2	400	10.0	60	1.2	5	0.8	85	1986/08/18
17	10	600	-	-	400	13.0	70	1.0	10	0.5	20	1986/07/16
23	11	700	N	20	400	7.0	60	1.6	75	0.2	80	1986/07/19
21	12	400	S	7	400	25.0	85	1.2	20	1.0	50	1986/07/17
16	13	650	S	10	400	13.0	60	1.5	5	0.6	80	1986/07/26
18	14	800	W	5	400	8.0	70	2.0	20	0.3	50	1986/07/25
22	15	1230	N25E	30	400	15.0	60	1.5	15	0.5	70	1986/07/01
24	16	680	S10E	14	400	15.0	60	1.5	60	0.4	80	1986/07/26
25	17	1140	N20E	10	400	17.0	80	3.0	20	0.2	80	1986/06/25
26	18	400	-	-	400	6.0	70	1.0	20	0.8	95	1986/07/30
27	19	460	W	3	400	4.5	80	1.5	30	0.5	40	1986/08/03
29	20	500	W	1	400	8.0	75	1.0	10	0.6	30	1986/07/09
19	21	560	S30E	3	400	16.0	60	2.5	30	0.8	90	1986/07/10
30	22	440	S	5	400	4.0	70	1.5	60	0.4	50	1986/08/03
28	23	300	W	2	400	8.0	60	1.5	40	0.3	30	1986/08/05
15	24	450	W	2	400	6.0	50	1.0	30	0.8	90	1986/08/03

2. *Corylus heterophylla*-*Betula platyphylla* community

The *Corylus heterophylla*-*Betula platyphylla* community occupies the mesic sites e.g., toe slopes and west aspects with low elevation, in general below 600 m in the region. The height of stands is generally less than 16 m.

2.1 Character and differential species

Corylus heterophylla

Geranium dahuricum

Rubia cordifolia

Pteridium aquilinum

Lysimachia davurica

Thalictrum simplex

2.2 Major composition species

Tree layer

Betula platyphylla, *Larix gmelinii*, *Populus davidiana*, *Quercus mongolica*, *Betula davurica*.

Shrub layer

Corylus heterophylla, *Rosa davurica*, *Rubus saxatilis*, *Salix starkeana*, *Rubus arcticus*, *Lespedeza bicolor*, *Salix raddeana*.

Herb layer

Geranium dahuricum, *Rubia cordifolia*, *Pteridium aquilinum*, *Lysimachia davurica*, *Thalictrum simplex*, *Sanguisorba officinalis*, *Deyeuxia angustifolia*, *Artemisia laciniata*, *Convallaria keiskei*, *Fragaria orientalis*, *Carex ussuriensis*, *Adenophora tetraphylla*, *Galium verum*, *Pyrola incarnata*, *Chamaenerion angustifolium*, *Saussurea serrata*, *Maianthemum bifolium*, *Vicia pseudocracca*, *Sedum aizoon*, *Filipendula palmata*, *Carex lanceolata*, *Moehringia lateriflora*, *Vicia unijuga*, *Valeriana stubendorfi*, *Veronica sibirica*, *Asperula maximoviczii*.

2.3 Number of species

Mean: 33 species

Range: 24-41 species

3. *Artemisia stolonifera*-*Betula platyphylla* community

Artemisia stolonifera-*Betula platyphylla* community also occurs on mesic sites with toe slopes in high elevations, generally above 600 m (Table 2). Mature forests reach 15 m with rich herb species and sporadic shrubs.

3.1 Character and differential species

Artemisia stolonifera

Saussurea neoserrata

Vicia cracca

Scabiosa comosa

Polygonatum humile

Anemone narcissifolia

Hemerocallis minor

3.2 Major composition species

Tree layer

Betula platyphylla, *Larix gmelinii*, *Populus davidiana*.

Shrub layer

Rosa davurica, *Rubus saxatilis*, *Salix starkeana*, *Spiraea media*, *Vaccinium uliginosum*.

Herb layer

Artemisia stolonifera, *Saussurea neoserrata*, *Vicia cracca*, *Scabiosa comosa*, *Polygonatum humile*, *Anemone narcissifolia*, *Hemerocallis minor*, *Sanguisorba officinalis*, *Deyeuxia angustifolia*, *Artemisia*

laciniata, *Fragaria orientalis*, *Carex ussuriensis*, *Adenophora tetraphylla*, *Galium verum*, *Pyrola incarnata*, *Chamaenerion angustifolium*, *Saussurea serrata*, *Lathyrus humilis*, *Maianthemum bifolium*, *Vicia pseudocracca*, *Sedum aizoon*, *Filipendula palmata*, *Carex lanceolata*, *Moehringia lateriflora*, *Vicia unijuga*, *Iris uniflora*, *Adenophora gmelinii*, *Geranium eriostemon*, *Plomonium linifolium*, *Trollius ledebourii*, *Paeonia obovata*, *Aconitum volubile*, *Valeriana stubendorfi*, *Veronica sibirica*, *Asperula maximoviczii*.

3.3 Number of species

Mean: 28 species

Range: 16-32 species

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